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possible that a more mesophytic grassland may be the climax, with the formation of a turf resisting erosion.

Investigations by BHIDE[12] during one of the worst droughts on record, in 1918–19, have taken into account some of the plants showing the most successful resistance to such arid conditions. Such data not only add to our knowledge of the existing vegetation, but furnish material for improving existing economic conditions in a region where grazing is of first importance.

The anatomy of many plants of the arid region is also being investigated by SABNIS.[13] The results of such efforts are certain to be valuable for India and interesting to botanists elsewhere.—G. D. FULLER.

Tension zone between forest and prairie.—Following an earlier study by WEAVER and THIEL, an interesting tension zone investigation has been carried on by POOL, WEAVER, and JEAN[14] in eastern Nebraska. Stations were selected at Peru, near the Missouri River, and at Lincoln, sixty miles west of Peru. By means of quantitative experimental study, striking contrasts between these two stations, due to both climatic and edaphic factors, were brought to light. The prairies and woodlands near Lincoln are much more xerophytic than those near Peru, in spite of the short distances involved between the two places. Available soil moisture during the summer of 1917 was exhausted on eighteen different days on a Lincoln prairie and on only four different days on a comparable Peru prairie. Many mesophytic woodland species pass out in traversing the area between these two places. The high saturation deficit and the low soil moisture content of the prairie sites in eastern Nebraska constitute barriers over which forest trees can scarcely pass. The authors feel that herein is the most ready explanation for the confinement of Nebraska woodlands to the moist slopes of narrow valleys and for the general treelessness of prairies. In the order of increasing mesophytism, the forests about Peru are as follows: bur oak-yellow oak, black oak-hickory, red oak, linden-ironwood, while the common forest type about Lincoln is that of the bur oak-hickory.—H. C. COWLES.

Composition of plants as affected by nutritive elements.—Growing the oat plant in analyzed quartz sand, DICKSON[15] has made a study of the effects of a deficiency of certain nutrient elements on the calcium and phosphorus content of the plant. The elements, the amount of which present in the nutrient solutions was varied, were calcium, magnesium, potassium, phosphorus, and nitrogen. The plan was to reduce the amount of these elements present to the lowest concentration that would allow the production of grain. This concentration would be below that required for the normal development of the plant, and it was thought that in such conditions the effect of the elements on the composition of the plant would be more strikingly brought out. Aside from the greatly reduced calcium or phosphorus content, when the amount of these elements in the respective nutrient solutions was reduced, the most striking results obtained were the low calcium content of the plants of the low phosphorus series and the low nitrogen series, and the high phosphorus content of the plants of the low calcium series and the low nitrogen series. Potassium and magnesium seemed to have little effect on the calcium and phosphorus content of the plant. Climatic factors, on the other hand, were shown to have a decided effect on the composition of the plant. A good bibliography is added.—S. V. EATON.

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[12] BHIDE, R. K., Drought resisting plants in the Deccan. Jour. Indian Bot. **2**: 27–43. 1921.

[13] SABNIS, T. S., The physiological anatomy of the plants of the Indian desert. Jour. Indian Bot. **2**:1–19, 61–79, 93–115. 1921.

[14] POOL, R. J., WEAVER, J. E., and JEAN, F. C., Further studies in the ecotone between prairie and woodland. Univ. Nebraska Studies **18**:1–47. *figs. 17.* 1918.

[15] DICKSON, J. G., The relation of certain nutritive elements to the composition of the oat plant. Amer. Jour. Bot. **8**:256–274. *figs. 2.* 1921.

Alkali soils.—The hardening of irrigated land has been studied by SCOFIELD and HEADLEY,[16] who conclude that neutral salts of sodium as well as the carbonate, "black alkali," may produce hardening of the clay component of soils. The results are about the same, whether sodium-containing water is used on good soils, or whether pure water is used on salty soils; in either case the soil will harden seriously on drying, and become somewhat impervious to water. The theory advanced to explain the action of sodium on clay is that the sodium replaces other bases on the surface of the particles, and becomes in part sodium silicate. This hydrogel coating increases the effective size of each particle, reduces the porosity of the soil, and greatly retards water percolation through it. On drying, the colloidal gel cements the particles together, whence the hardness of these soils. If enough calcium or aluminium is present, however, the harmful action of sodium is obviated. When irrigation water contains more Na and K together than Ca and Mg, it is likely to cause hardening. The Colorado River and its lower tributaries contain too much of the hardening salts. The authors think injury to irrigated land may be avoided by treatment of irrigation water or land with soluble calcium or aluminium salts.—C. A. SHULL.

Nitrogen fixation by green plants.—WANN[17] presents some interesting results of experiments showing that members of the Chlorophyceae can utilize the uncombined nitrogen of the atmosphere. Seven species exhibited this

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[16] SCOFIELD, C. S., and HEADLEY, F. B., Quality of irrigation water in relation to land reclamation. Jour. Agric. Res. **21**:265–278. 1921.

[17] WANN, F. B., The fixation of free nitrogen by green plants. Amer. Jour. Bot. **8**:1–29. *pl. 1. fig. 1.* 1921.